

WHAT IS CLAIMED IS:

1. A method for fabricating a semiconductor optical device, comprising the steps of:

- a. alternately stacking two or more types of semiconductor layers
- 5 having different etch rates on a semiconductor substrate;
- b. patterning the stacked semiconductor layers using a given mask;
- c. forming a mesa structure to etch selectively at least one type of semiconductor layers resulting in an air-gap structure, wherein the mesa structure is composed by the rest of the semiconductor layers; and
- 10 d. depositing a material having a good heat transfer property so that the air gap is buried.

2. The method according to claim 1, wherein the semiconductor layers stacked in the step b are patterned so that widths of device regions thereof are

15 narrower than those of supporting regions at both sides of the device regions.

3. The method according to claim 1, wherein the semiconductor layers stacked in the step b are patterned so that a width of a device region thereof is narrower than that of a supporting region at one side of the device region.

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4. The method according to claim 1, wherein the semiconductor layers are materials that can be grown by a crystalline growth on the semiconductor substrate.

5. The method according to claim 1, wherein the material having the good heat transfer property is an oxide, a nitride, or a mixture thereof.

5           6. The method according to claim 5, wherein the material having the good heat transfer property is one of  $\text{Al}_2\text{O}_3$ ,  $\text{ZnO}$ ,  $\text{MgO}$ ,  $\text{TiO}_2$ ,  $\text{Ta}_2\text{O}_5$ ,  $\text{ZrO}_2$ ,  $\text{HfO}_2$ ,  $\text{SiO}_2$ ,  $\text{Si}_3\text{N}_4$ ,  $\text{AlN}$ , and  $\text{AlON}$ , or a combination thereof.

7. The method according to claim 5, wherein the material having the  
10 good heat transfer property is deposited by an atomic layer deposition method.

8. The method according to claim 1, wherein the semiconductor optical device is a reflector or an optical filter.